What is claimed is:

1. A lead-free bump obtained by forming an Sn-Ag alloy film having a lower Ag content than that of an Sn-Ag eutectic composition by plating and reflowing the plated alloy film.

2. The lead-free bump according to claim 1, wherein the Ag content in the plated Sn-Ag alloy film is 1.6 to 2.6% by mass.

3. The lead-free bump according to claim 1, wherein the maximum temperature of the reflowing the plated alloy film is not higher than 240°C.

4. The lead-free bump according to claim 1, wherein the Ag content in the plated alloy film is adjusted to be lower than the Ag content of the Sn-Ag eutectic composition by controlling a composition of a plating bath and electrodeposition conditions.

5. The lead-free bump according to claim 1, wherein the amount of α-rays emitted from a surface is not higher than 0.02 cph/cm^2.

6. A method of forming a lead-free bump comprising:

carrying out Sn-Ag alloy plating on a portion on which a bump is formed while controlling the composition of a plating bath and electrodeposition conditions so that a plated Sn-Ag alloy film having a lower Ag content than that of the Sn-Ag

eutectic composition is formed; and then

reflowing the plated alloy film.

7. The method of forming a lead-free bump according to claim 6, wherein the Ag content in the plated Sn-Ag alloy film is 1.6 to 2.6% by mass.

8. The method of forming a lead-free bump according to claim 7, wherein the maximum temperature of the reflowing the plated alloy film is not higher than 240°C.

9. The method of forming a lead-free bump according to claim 6, wherein the control of the composition of the plating bath and the electrodeposition conditions is carried out by changing the electrodeposition conditions while keeping the ratio of concentration of Ag ion to Sn ion in the plating bath constant.

10. The method of forming a lead-free bump according to claim 6, wherein the control of the composition of the plating bath and the electrodeposition conditions is carried out by changing the concentration ratio of Ag ion to Sn ion in the plating bath while keeping the electrodeposition conditions constant.

11. A plating apparatus for forming a lead-free bump, comprising:

a plating vessel for containing a plating solution having Ag ions and Sn ions;

an anode;

a holder for holding a workpiece and feeding electricity to the workpiece;

an electrodeposition power source for feeding electricity to the anode and to the workpiece held by the holder;

a replenishment mechanism for replenishing the plating solution with Ag ions and Sn ions;

an analyzer for monitoring Ag ions and Sn ions; and

a control mechanism for controlling, on a basis of analytical information from the analyzer, an Ag content in a plated Sn-Ag alloy film formed on a surface of the workpiece at a value lower than an Ag content of an Sn-Ag eutectic composition.

12. The plating apparatus for forming a lead-free bump according to claim 11, wherein the Ag content in the plated Sn-Ag alloy film is controlled within the range of 1.6 to 2.6% by mass.

13. The plating apparatus for forming a lead-free bump according to claim 11, wherein the Ag content in the plated Sn-Ag alloy film is controlled by adjustment of concentrations of Ag ions and Sn ions in the plating solution and/or change of electrodeposition conditions.

14. The plating apparatus for forming a lead-free bump according to claim 11, wherein the anode, the holder and the plating vessel are made of materials whose amount of emission of α-rays is low so that an amount of α-rays emitted from a surface of the plated Sn-Ag alloy film is made not higher than 0.02

cph/cm^2.

15. The plating apparatus for forming a lead-free bump according to claim 11, wherein the anode comprises an insoluble anode.

16. The plating apparatus for forming a lead-free bump according to claim 11, wherein the anode comprises a soluble anode.

17. The plating apparatus for forming a lead-free bump according to claim 16, wherein the anode comprises an Sn anode.